A REPORT

ON THE PUBLIC

Water Supply of the City of Mansfield, Ohio,

BY

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Made Before the City Council at a Special Meeting, Held for the Same, Oct. 21st, 1887.

Gentlemen of the Honorable Council of the City of Mansfield:

I had the honor to receive a communication from the city clerk, dated April the 15th, 1887, informing me that you had instructed me to have a chemical analysis made of our city water, and report the same to you.

I at once set about the task, and secured the services of Prof. C. C. Howard, chemist for the Ohio State Board of Health, and professor of chemistry in the Starling Medical College, of Columbus, Ohio, and I now beg leave to report the results of our investigations.

In order that you may have a better understanding of our report, we will here give a brief description of the artesian wells and springs, from which the city is supplied with water.

Prior to the summer of 1886, you, no doubt, all remember that our city was supplied with water from what is known as the Laird Spring, which is located about a mile north of the extreme northern city limits, together with the springs in the reservoir which is located in the valley of the Rocky Fork, which is not more than three quarters of a mile north of the city limits, and perhaps one quarter of a mile east of the Laird spring.

This supply, as our city grew larger and the demand increased, was found to be insufficient, and frequently the filthy water of the Rocky Fork, which is scarcely more than a mere run, had to be utilized to the inconvenience, and often the illness and disgust, of our citizens.

During the summer of 1886 however, the water works trustees quietly undertook the experiment of obtaining an increase to our water supply by drilling artesian wells, and were rewarded for their experiments by a rich find of flowing water, or as Prof Roberts, of Philadelphia, in speaking of them, puts it, "wonderful artificial geysers."

Well No. 1 is located just west of the Laird spring, and was drilled during the summer of 1886, and is 152 feet deep, 75 feet of which is through yellow sandstone, and 77 feet through a bluish sandstone. This well, when first struck, threw a strong three inch stream of water that would rise, when piped, several feet above the surface, but is now plugged, and is not running for reasons which will be explained hereafter

Well No 2 is located perhaps a hundred and seventy-five feet south of the Laird spring, and was drilled during the summer of 1886, It is now two hundred feet deep; first, passing through yellow sandstone, after which a blue sandstone was struck, in which the vein of water was found. It was observed by the drillers that there was a subterranean connection between these two wells, which are located perhaps one hundred and seventy-five feet apart, in consequence of which well No. 1 was plugged, and all the water was allowed to flow out of No. 2 well's pipe, from which the specimen for analysis was procured.

Well No. 3 is located at the north west corner of the reservoir, and is known as the north well of "the twins." This well was drilled during the summer of 1886, and was originally fifty feet deep, mainly through yellow sandrock, and was a very strong well filling a six-inch pipe and rising several feet above the surface when piped.

This well, in the summer of 1887, was sunk thirty-six feet deeper, making the entire depth eighty-six feet, increasing its flow very considerably.

Well No. 4 is located at the north west corner of the reservoir, and is known as the south well of "the twins," and is only about fifty feet from its fellow, and not more than that from the reservoir. This well was drilled during the summer of 1886, and originally was only fifty feet deep, which was principally through yellow sandrock, but during the summer of 1887, it was driven fifty feet deeper, making it one hundred feet in all, which increased its flow materially. It is almost a duplicate of No. 3, both throwing a constant six-inch stream.

Well No 5 is located near the southwest corner of the reservoir, and is about four hundred feet south of "the twins," and almost opposite the gate of entrance It was drilled in the spring of 1887, is seventy-five feet deep, and principally through yellow sandrock, and throws a four-inch stream which can be raised several feet above the surface.

Well No 6 is located at the northeast corner of the reservoir, about one hundred and twenty-five feet east of "the twins," and was drilled during the spring of 1887, and is one hundred and sixteen feet deep, thirty-six feet through clay, fifty-four feet through yellow sandrock, striking the water after drilling twenty-six feet in the blue sandstone. It throws a strong

six-inch stream, which can be raised several feet above the surface.

Well No. 7 is located at the west side of the reservoir, about midway between "the twins" and well No. 5, and was drilled early during the summer of 1887, and is one hundred and eighty-four feet deep, thirty-one feet of which is through clay, sixty-four feet through yellow sandrock, and eighty-nine feet into the blue sandstone, where a strong six-inch stream of water was struck, which can be raised, by piping, several feet above the surface.

These "wonderful artificial geysers," as they have been called, with the exception of Nos. 1 and 2, are all flowing just as strong, apparently, as ever, notwithstanding the extremely dry summer.

Immediately after the preliminary report was received of the large quantity of free ammonia found in the sample of water sent from well No 2, the water works trustees closed that well also, and both wells at the Laird spring have been closed ever since.

The Laird spring is a natural spring which has been excavated and walled up on one side, the others being simply a bank of yellow clay, surrounding a basin of some twenty-five or thirty feet in diameter, in which rise a number of "natural springs," filling the basin to the depth of from three to five feet.

The bottom of this basin is composed of a soft blue mud mingled with clay, washed in from the banks with each heavy rain, while the water in the basin of this spring is seldom found free from a green scum-like, algae, which grows in abundance almost the year around.

As stated before, the city reservoir is located about three quarters of a mile north of the city, and is situated at the foot of a hill, in the valley of the Rocky Fork of the Mohican, a small stream that flows past the city to the south east.

This reservoir is simply an excavation made in the drift and clay, at this point, and is some four hundred feet long, by about one hundred and twenty-five feet wide, and from ten to fifteen feet deep in the center, and with the exception of a short distance at the north east side where a few loads of stone have been thrown into it, it is neither paved nor cemented.

Near the north end of this reservoir is located a strong "natural spring," which gushes up from its clay bottom the year around, in a stream sufficiently strong to fill from a six to an eight inch pipe; while near this "natural spring" is the opening of the inflow pipe from the Laird spring, while beside these, a number of smaller "natural springs" rise from this basin also

During the summer large quantities of a species of fresh water algae grow in this reservoir, which are usually removed just as soon as they begin to die or decay, which is soon discovered by the offensive smell and taste they give to the water. From ninety to one hundred tons of this cryptogamic product are removed from our reservoir annually.

During the past summer, vast numbers of a small, thread like, greenish worm infested the reservoir, which were pumped up by the thousands, and could be found escaping from almost any hydrant in the city, by simply tying a piece of cheese cloth or fine muslin over the mouth of the hydrant, and thus strain the water. I have caught as many as a hundred or more in a day, at one hydrant, and especially about the time the algae began dying, and even after the reservoir was cleaned out.

This worm seems to be a parasite that lives and feeds on this algae, and came with its maturity and soon disappeared after its destruction.

Another mysterious denizen of this reservoir is a little fish, known by the popular name of stickleback or banstickles, which is a foreigner to the waters of this section of the country, but is found in great quantities in this reservoir This little stranger has never been found to be over two or three inches in length, and is of a dark mottled brown color, has no scales, is very pugnacious, and remarkable for its peculiar dorsal and ventral spines, of which there are five of the former and two of the latter. Although found in great abundance in Great Britain, and occasionally found in some of the eastern states, these curious little fish are unknown to this section of the country, and there being no other species of fish in this reservoir, the question naturally arises as to where these little emigrants come from? In the absence of any direct proof as to the source of their origin, I am of the impression that their eggs were carried, perhaps long distances, probably from the source of this wonderful supply of water, where they may be indiginous, and by the means of these subterranean currents of water, finally found their way into this basin and were hatched, and by degrees have multiplied and replenished it

TEMPERATURE.

On Sept 6th, 1887, the temperature of the water supplied the city was carefully taken, and showed the following results:

Laird spring, average temperature,	52⅔° F.
Well No. 3, temperature,	50° "
" " 4, "	51° "
" " 5, "	52° "
" " 6, "	51° "
" " 7, "	51° "
Reservoir, average temperature,	62° "
Hydrant (in my house), "	60° "

CHEMIST'S REPORT.

COLUMBUS, O., Oct. 14th, '87.

R Harvey Reed, M D., Mansfield, O.

DEAR SIR:—I have completed a chemical examination of the water

from the public wells of Mansfield, with the following results:

DESCRIPTION OF SAMPLES.

No. of Sample.	Special Mark.	Date sample was received.	SPECIAL DESCRIPTION.
1	1	April 23d, 1887.	Water from well No. 2 South of Laird spring.
2	00	May 6th,	" " " Laird spring.
3	00a	Sept. 2d,	Well No. 3, north well of "twins."
4	2	April 23d,	" " 4, south " " "
5	3	"	" " 5, near gate of entrance.
6	4	"	" " 6, northeast corner.
7	6	May 6th,	Hydrant at Dr. Reed's residence.
8	5	April 23d,	" " " "
9	5a	Sept. 2d,	" " " "
10	7	" 23d,	Well No. 7, west side of reservoir.

TABLE OF RESULTS.

PARTS PER 100,000.

Number	Special Mark.	Oxygen Required	Free Ammonia	Albuminoid Ammonia	Nitrous Acid.	Chlorine.	Total Solids.
1	1	.07	.050	.010	trace	1.09	34.4
2	00		.046				
3	00a	.07	.011	.007	trace	.92	33.4
4	2	.04	.0005	.002	none	.32	50.
5	3	.02	.0008	.003	none	.35	41.1
6	4	.05	.0005	.006	none	.49	40.2
7	6	.05	.0007	.004	trace	.42	42.6
8	5	.06	.005	.005	trace	.39	40.8
9	5a	.04	.0006	.004	none	.53	43.2
10	7	.09	.0008	.005	none	.42	45.6

LAIRD SPRING AND WELLS SUPPLYING IT.

The most remarkable point in this water (analyses Nos. 1, 2 and 3), is the large quantity of free ammonia it contains, fifty times the amount found in water of high standard. From the small quantity of other constituents present, derived from the decomposition of organic matter, and in the absence of positive proof, it would not be safe to declare the water contaminated. That the ammonia is not derived from the decomposition of organic matter is further indicated by the fact that while the ammonia had sunk from .050 on April 23 to .011 on Sept. 2, the other constituents remained practically unchanged.

I have not been able to satisfy myself of the origin of this ammonia.

In England it has been shown that "in some cases the ammonia found in waters from the chalk beneath the London clay is derived from the decomposition of nitrates."

That the ammonia found in this water is of similar origin, can be thus far only a matter of conjecture.

WATER FROM WELLS AT MAIN RESERVOIR.

Analysis shows that the water which flows from the five wells described is of the same quality, and that it is a water of great organic purity. The saline constituents are somewhat high, rendering the water a little too "hard" for an ideal water, but the purity of the water partially atones for this defect.

It is a matter of congratulation that the people of Mansfield have an abundant supply of such excellent water.

Near the reservoir I found a large quantity of vegetable matter, which I was informed had been removed from the reservoir.

I think it would be well to guarantee the continued purity of the water as it stands in the reservoir, by paving or cementing the basin so as to prevent the growth of these water plants.

HYDRANT WATER.

The examination of this water as supplied to the city April 23rd, when obtained from both the Laird and main reservoirs, showed a larger quantity of free ammonia (.005 per 100,000) than is consistent with an excellent water, provided its source be objectionable.

As the water from the wells at the main reservoir contained less than .001 part, and that from the Laird spring contained .050 parts, it is evident that this increased quantity arose from the latter source.

If we admit the harmless origin of the ammonia at the Laird spring, it is evident that this high proportion of ammonia in the hydrant water has no significance.

In the water supplied the city Sept. 2, obtained exclusively from the wells at the main reservoir and the Laird spring, (wells Nos. 1 and 2 having been shut off,) the free ammonia was only .0006 or about the average of that in the water of the wells.

Very respectfully,

CURTIS C. HOWARD.

When we remember that the human body is composed of 58.5 per cent. of water, varying in quantity in the different tissues, we can truly agree with Landois, who said "water is of the utmost importance in the economy, and it is no paradox to say that all organisms live in water, for though the entire animal may not live in water, all its tissues are bathed by watery fluids, and the essential vital processes occur in water. A constant stream of water may be said to be passing through organisms," and hence it hath been truly said that "the most important substance used as food is water."

You will now certainly pardon me for my earnestness in this matter, which at times may have seemed to some of you as even verging on what the thoughtless would call "crankiness" over an apparently small and trifling matter.

Yet, gentlemen of the honorable council of Mansfield, on the purity of the water your citizens drink, depends, to a very large extent, the health of our community, and on the health of our community depends the prosperity of our thriving city.

Are not these reasons enough for having asked you to get our city water analyzed? and yet these are not the only reasons. We still have many citizens who either use well water from choice, or are compelled by their landlords to use it for economy's sake, who don't want to go to the expense of giving their tenants good, healthy water, and when you go to them and ask them to close their wells, and tell them their well water is bad, they will say to you, as they have said time and again to me, "how much better is your city water? Suppose my well water is not first class, how do you know that your city water is any better?"

With this analysis, such excuses will soon be known only in history, and from now on, landlords will no longer be able to fortify themselves behind our ignorance of the real condition of our city water, in order to force their tenants to use impure water because it is cheap, and we could not prove to them the hydrant water was any better.

The question now arises as to what, if any thing, can be done to improve the present condition of our city water.

It is not enough to content ourselves in an investigation like this by simply hunting for the good; we should look for imperfections as well, and seek to remedy them as far as possible.

In this direction I would recommend, 1st. That our artesian wells be piped direct to the pumps, and that our daily city supply be pumped directly out of these flowing wells, and if the present number be not sufficient to supply the city, that additional ones be drilled until the supply is adequate to the demand.

2nd. That the reservoir be kept only for fire purposes, and the pipes now leading from it to the pumps, be utilized for that end.

The benefits derived from such a change are self evident, and would be:

1st. To prevent the introduction of any foreign material into the water.

2nd. To prevent the water from becoming warm during the summer by exposure to the sun, for as late as the 6th of Sept. you will notice the water in the reservoir was 10° warmer than that of the wells.

3rd. Economy with general improvement over our present excellent supply.

Whilst there has been no apparent evidence of ill health from the growth of the immense quantities of algae that grew in the reservoir annually, and whilst no one has been poisoned by drinking worms during the past summer, or choked by little fish, yet it must be conceded by everyone that their presence in our drinking water is certainly not desirable, and should be prevented, if possible, and the quickest, most effective, and cheapest way to get rid of all these objections is to connect the pumps directly with the wells.

It is true that the growth of this algae could probably be arrested by paving or cementing the reservoir, and thus get rid of the worms also, yet this would not only be troublesome but expensive, and still leaves the reservoir open for the introduction of foreign matter that could all be absolutely avoided by disposing with it altogether, except for fire purposes, saying nothing of the increase of temperature produced by constant exposure of the water to the atmosphere and the effect of the sun during the summer.

Should the reservoir, however, still be continued, it would be well, owing to the low standard of the limited supply of water received from the Laird springs, to shut them off altogether, at least as long as the supply of the reservoir is as pure and bounteous as it now is; and further, should the reservoir system be continued, it should be either thoroughly paved or cemented, and every precaution possible taken to prevent the growth of the algae, and the consequent infection of the water by worms, as well as the multiplication of the fish now found in this basin, and thus not only maintain the present high standard and purity of our city water, but improve it until we can *truly* claim for our public water supply, there is *none* better, and *few half* so good.